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ABSTRACT

The Cleveland Museum of Art has embarked on an innovative approach for delivering high quality video-on-demand and live interactive cultural programming, along with Web-based complementary material, to seniors in assisted living residence facilities, community-based centers, and disabled persons in their homes. The project is made possible in part by a grant from the Technology Opportunity Program (TOP), National Telecommunications and Information Administration, U.S. Department of Commerce totaling more than $500,000. The purpose of the grant is to demonstrate how emerging broadband telecommunications technology can deliver "lifelong learning and the arts" to populations for whom direct involvement with cultural institutions would otherwise not be possible. The approach uses Cisco IP/TV interactive video archive/broadcast servers and broadband multicast technology in a controlled public infrastructure environment, rather than the closed corporate or campus network environment for which it was designed. In addition to describing the program design and operation, this paper analyzes how this Museum, whose core competency is not, nor should be, advanced technology development and management, mustered the expertise to achieve technological innovation in pursuit of programmatic goals. It also focuses on the process of convening outside individuals, organizations, and expertise to complement each other to achieve a common goal. (Author)

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Using Interactive Broadband Multicasting In A Museum Lifelong Learning Program

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Abstract

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The approach uses Cisco IP/TV interactive video archive/broadcast servers and broadband multicast technology in a controlled public infrastructure environment, rather than the closed corporate or campus network environment for which it was designed. In addition to describing the program design and operation, this paper analyzes how this Museum, whose core competency is not, nor should be, advanced technology development and management, mustered the expertise to achieve technological innovation in pursuit of programmatic goals. It also focuses on the process of convening outside individuals, organizations, and expertise to complement each other to achieve a common goal.

Key Words: Cisco, Cleveland, TOP, Commerce, IP/TV, broadband, router, multicast, lifelong learning, older persons, assisted living, disabled, grant, evaluation, infrastructure, TOP, Technology Opportunity Program, CIO, core competency, isolation, MPEG, RTP, distance learning, Keane, APK, WVIS, PBS, Cleveland Orchestra, DSL, ADSL, IP Multicast, Windows Media Player, broadcast, video-on-demand, Institute for Learning Innovation, John H. Falk

Introduction

Be forewarned! You are about to read a tale of great technological, social, and educational aspiration. Of community groups, corporate interests and federal funding. Of populations isolated and impaired. Of external evaluation and intradepartmental coordination. It is a work in progress about which the known facts are provided and our hopes for the future are unveiled.

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This paper presents an innovative approach for using broadband multicast technology to deliver high quality video-on-demand and live interactive cultural programming, complemented by Web-based resources, to seniors in assisted-living residence facilities, community-based centers, and disabled persons in their homes. But that is a rather cold description. We want to change people's lives through continuing lifelong learning and the arts and interaction with each other. We strive for no less than arousal of the spirit, though we will define our goals a bit less spiritedly later on. The technology we have chosen comprises the best tools we could find at this time, ones we believe harbinger the future. The combination of technology, program and process form an experiment which has been funded. No doubt the details of technology will change dramatically over time, but we hope that the process and program model we are presenting will survive, evolve and prove useful to others.

Background

To understand the genesis of the program, it is important to understand its host's core values and experience. The Cleveland Museum of Art, established in 1916, is one of the finest encyclopedic art museums in the United States and is an integral part of Cleveland's cultural and civic identity. As an institution established "for the benefit of all the people forever," the Museum welcomes close to 600,000 visitors each year. The Museum also has a long history of extensive public programming in film, music, and dance as well as art-related classes, lectures and family programs. In addition, the Museum has strong relationships with the community and community groups through a range of outreach programs and community festivals as well as its teachers school services, and adult continuing education programs. Most recently, in 1998, the Museum became a content provider and remote site for the Ohio SchoolNet Program. Ohio SchoolNet provides live interactive distance learning programs for students in grades K-12 throughout the state (http://www.osn.state.oh.us). This is all no quirk of fate. The Board of Trustees had long established the Museum's strategic goal of creating "rich and diverse educational and public programs that serve and engage many different audiences and communities in an innovative and dynamic fashion."

In addition to its education context, the emerging role of technology within all areas of the Museum was recognized by the Board. This resulted in another important strategic goal: "to become a national leader in the use of new and emerging technologies to enhance the value to society of the museum's collections, intellectual initiatives, and other activities." To accelerate progress in this area, in 1999 the Museum established a new Information Technology Division (I.T.), headed by a Chief Information Officer (CIO) on peer level with other senior management and reporting to the Museum director. The new CIO (the author) immediately established a guiding doctrine for technological leadership and adventurism: "The core competency of a museum is not the mastery of diverse, complex technologies... it is the creative use of them." There is no contradiction here. It is quite possible for a Museum to achieve its techno-dreams without insisting that it find the capital and human resources necessary to become the be-all end-all of complex technology knowledge and management. This principle will be echoed throughout this project plan.

This backdrop is important. Without a history of community involvement,

strong educational programs, and a dedication to the use of new and evolving technologies, it is unlikely that the Museum would ever have conceived of this project nor received the funding and other support needed to make it happen.

(Technology) Opportunity (Program) Knocks

In the fall of 1999, the Museum became aware of the availability of funds for 2000 from the Technology Opportunities Program (TOP) of the National Telecommunications and Information Administration of the U.S. Department of Commerce. Since 1994, this has been a highly competitive, merit-based federal grant program that brings the benefits of an advanced national information infrastructure to communities throughout the United States (http://www.ntia.doc.gov/otiahome/top). The focus of its funding may vary from year to year, but for FY2000 the intent could not have been more congruent with the Museum's interests. TOP was "especially interested in projects...using advanced network technologies...for example, broadband networks... to deliver immense amounts of data quickly to the desktop." In addition, the notice identified "Lifelong Learning and the Arts" as an area of interest, particularly "training and instruction to lifelong learners in non-traditional settjngs such as homes (and) community centers." With this scope defined, we proceeded to explore whether there was a program the Museum would want to develop which would further its goals. However, it is not our nature to contort our goals in order to "follow the money."

Lurching Toward the Bait

As would be expected, there was significant brainstorming within the Museum, including staff and leaders from Information Technology, Development, Education, Curatorial, and Community Outreach. We had many answers and ideas, but finally realized that the truth lay not in ourselves but in our stars... our friends and colleagues in the community. We held a technology/program brainstorming party. Colleagues from SchoolNet, from schools, and from nearby cultural organizations converged. Representatives of Community groups aggregated. Technology companies whose help might be needed in specification and installation were there to keep our feet nailed to the ground. (Luckily, we still could reach for the sky.) Curious curators convened. The public TV station was tuned in and got turned on. You could not have too many cooks in this kitchen. After two hours of guided discussion a general consensus seemed to evolve. We would focus on isolated older persons in residential facilities or those who frequented community centers, and, if possible, disabled persons who primarily spend their time at home. We would provide both programming on demand and live interactive programs where they live or congregate. It felt right and meshed with Museum goals. However, more precise goals and next steps would have to be defined.

Before addressing those issues, it is noteworthy that this meeting, born of prior excellent relationships within the community, generated more than a concept. Our guests informed our thought process, and we made it clear that we were in this together. This setting of stage would prove invaluable as the project moved forward.

At this point, the project development process still had to answer several critical questions:

- What did we hope to achieve?
- Was there available technology which would let us demonstrate the conceived program at feasible cost and effort?
- Would residential facilities and community-based organizations commit to participating in this program?
- Where would we get the content, both live and archived, for this project?
- How could the Museum inaugurate this level of technology without diverting resources, or violating the precept of creatively using technologies without investing an inappropriate amount of time and effort in them?

Proof of Concept/Definition of Goal

Intuitively, it seemed reasonable to expect that older and impaired persons might benefit from interaction with cultural activities, but we needed to confirm our hunch. With the assistance of Malvin Schechter, a noted journalist, gerontologist, and consultant on issues of population and aging, important research findings were brought to our attention. Gerontological research seemed to assert that programs in the arts stimulate cognitive functions, enhance daily life experience, and trigger memories and creativity in older Americans. Research confirmed that being part of a social network and diminishing isolation and loneliness have significant impacts on health and longevity (Rowe & Kahn, 1997; Fees & Martin, 1999) . One study concluded that "interactive computing technology opens up access to levels of communication and personal control that impact directly on the quality of life for 'confined' individuals. Indeed, the term 'confined' loses much of its meaning when the world is at one's fingertips" (McConatha, McConatha & Dermigny, 1994).

The Museum also had its own experience in this area. For example, the museum has worked with the Cuyahoga County Board of Mental Retardation and its constituents for about three years in a studio art program.. Work with this population has already resulted in dramatic changes in participants' lives. The simple artistic freedoms like choice of colors or how to position the paper have increased confidence in participants who have since attempted other personal achievements. Participants in this program are now showing their artworks in community exhibitions. One individual learned to climb stairs for the first time at the museum, while another spoke his name for the first time in his life.

We knew enough to know we were on the right track. Our program goal was then articulated as follows:

> To enrich the lives of seniors and disabled adults through excellent arts programming delivered to them where they live and congregate via broadband technology. Arts-related programs will be delivered to participants at three types of sites: assisted living residence facilities, community-based centers, and private homes. Older as well as physically and emotionally disabled adults will benefit from relevant and rewarding exchanges with cultural institutions through the new technologies proposed herein by making it possible for them, for the first time, to participate in a broad range of excellent programs from which they have been historically isolated.

Specifically, we would:

- Develop an art program that provides a mechanism for intellectually stimulating older adult learners;
- Develop an interactive, art-based program that facilitates social engagement among older adult learners;
- Develop a delivery medium which can reduce the social isolation often associated with living in senior care facilities; and
- Develop a replicable model that can be used by other cultural organization seeking to deliver comparable content to similar populations via broadband technologies.

Most important, our program would explore and demonstrate how learning makes more meaningful the lives of older persons or disabled persons for whom a visit to the conventional museum and cultural institutions and activities would be difficult, inconvenient or impossible. We would hope to learn how these extramural programs might stimulate such audiences to inquire and learn in satisfying ways. Additionally, we would develop a model and experience base that, by the nature of content and technology, is replicable throughout the country, especially as this technology becomes increasingly available.

The Future is Now: Selecting the Technology

The technological vision for the project now had to emerge alongside the more programmatic and content-oriented goals. The vision was to establish a multi-point "distance learning-like" environment with some level of interactivity, one which would include archived material, additional Web-like content and Web access. The technology should be more open, less complex and less expensive than traditional video teleconferencing. After all, this is the way Internet is going: more, richer content and greater interactivity through affordable access to a high-speed public infrastructure. Even if it is not there yet, our charge was to be innovative in our use of broadband technology and demonstrate what the future may be.

This presented three technical issues: how to capture, digitize, and compress video; how to develop and manage a video archive which can provide video on demand on line; and, how to achieve an infrastructure for getting the content from the source to the client.

A special work group was established to discover what existing technology might be right for us. This small group initially included Museum I.T. staff and a consultant from Keane, Inc., a major national I.T. consulting firm which was engaged in another Museum project. He agreed to contribute the assistance.

Some prospects were easy to rule out. Although we considered cobbling a variety of products and technologies together to accomplish our goal, we knew this would conflict with our "core competency doctrine" and hobble our chance for success. The best opportunity for Museum support and a successful implementation would be as close to a turnkey solution as possible. Environments such as those available from Real Networks or Microsoft NetMeeting and others were immediately ruled out. The nature of both content and clients would demand close to full screen video of near television quality. We wanted our clients to have warm, seemingly familiar experiences with both our technology and our content. After all, the program was not targeted toward highly self-

motivated Internet users who would put up with quarter-screen jitters. Our content should be the reason for participating, and our technology should not get in the way.

We knew that we would require high-speed connections to our clients. We also realized that we were looking for an IP multicast solution, particularly for our live broadcasts. We decided that the increasing availability of ADSL (henceforth, DSL), with its emphasis on downstream speed, would be a feasible enabler (Craioveanu, 2000). We did not consider Internet access services through cable-TV providers, since this was not available in our area.

IP multicasting is defined as an "efficient means of transmitting of a single large stream of data to a group of selected users at the same time on a TCP/IP network such as the Internet" (http://www.techweb.com/encyclopedia). It is also fundamental to the evolution of the Internet as demand increases for better quality transmission of video and audio, and as transmissions become targeted toward groups rather than broadcast to all. IP multicast protocols have been under development since the early 1990's. Thus far they have been used primarily in corporate and academic environments where network traffic can be carefully engineered and monitored. We were aware of some public initiatives in this area, such as Mbone, since 1996 a cooperative and voluntary experimental virtual network within the Internet. This has been succeeded by other "bones," including 6bone and Qbone, and protocols, like the Internet itself, continue to evolve. But there is no current standard (Wirbel, 2000).

In addition to the protocol issues, IP multicast also requires a telecommunications infrastructure which is "multicast enabled." That is, it is comprised of routers and cabling which can handle the traffic demanded by rich media and which can also filter signals to allow clients to selectively receive transmission with a quality of service that would make the product palatable. (This is somewhat simplified, but sufficient for this purpose.) The current acceleration of commercial interest in IP Multicast is clearly evidenced by the IP Multicast Initiative, "a world-wide, multi-vendor forum accelerating the adoption of IP Multicast stimulating demand of IP Multicast products and related services" and significant source for articles, white papers, and conference information (http://www.ipmulticast.com). More than fifty companies now participate in this forum, including Cisco Systems, Real Networks, Yahoo Broadcast, and Lucent Technologies. There are even a number of national conferences each year focusing on this area. Although there may be some complex and costly workarounds, the public infrastructure was not ready yet for broadband IP multicast, even though we were.

Welcome to the Turnkey Multicasting System

Our product review brought us to Cisco Systems, Inc.'s IP/TV system. Cisco's IP/TV was chosen over other prospective solutions because it provides a more comprehensive set of features, in an end-to-end turnkey solution, than any other solution we could find (http://www.cisco.com). It comprises video capture with a choice of compression techniques, real-time broadcasting capability, video archiving, an Internet-based interface, and full router support at all points. As a tool designed for education and training applications within an academic or corporate environment, other features, including an interactive question manager and usage monitoring tools, would also

add value. A true broadband multicast solution (when used within a network infrastucture supporting these features), IP/TV can provide very high quality full- or near full-screen video, something we had identified as a requirement. We also decided that the implementation of a turnkey solution by a single well-known vendor had the added advantage of one-stop training and support. If our program model of content delivery proved successful, new and more feature-rich products could simply replace the elements we had chosen. Finally, because we would use Cisco routers, Cisco could be held responsible for the system's performance truly end-to-end. This initial assessment was followed by a product demonstration and tutorial for our technology team at Cisco's Cleveland office, and additional telephone conferences with Cisco's IP/TV specialists. The agreement that our local Cisco sales and technical reps would join our technology team as needed, and that the regional office would provide training and technical assistance to help assure project success, clinched the decision.

The decision was later bolstered by an informative case description of an IP/TV project at the Virginia Community College System (http://www.so.cc.va.us/vccsit/IPTVproj.htm).

The planned configuration of the Cisco IP/TV system comprises the following components:

- *IP/TV 3411 Control Server* which centrally manages the entire IP/TV system. The Control Server communicates instructions, such as scheduling information, available video types, and bandwidth considerations to IP/TV Broadcast and Archive Servers, along with program information, to the IP/TV Viewer client software at the workstation. Its interface allows system administrators to manage content, servers, and bandwidth, and schedule broadcasts. It also balances network video loads and optimizes network performance automatically. This server can be fully controlled remotely from any, even low speed, IP-connected terminal.
- *IP/TV 3422/3423 Broadcast Servers* capture and digitize, store, and transmit programs according to directions received from the Cisco 3411 Control Server. They are primarily used for multicasting live or prerecorded programs from devices such as video cameras, VCRs, DVDs, satellite, or cable feeds, or from prerecorded Windows Media, AVI, MP3, and MPEG files. The Server must be located physically near the source devices, such as cameras, mixers, etc., to which they directly connect. The model differences pertain to the servers' digitization format capabilities.
- *IP/TV 3431 Archive Server* provides large-volume storage capacity for Video on Demand (VoD). It enables the appropriate stored video programs to be delivered at the right time, to the right audience, whether streaming prerecorded video on a scheduled basis or responding to a singular request. This server can be fully controlled remotely from any, even low speed, IP-connected terminal.
- *IP/TV Viewer* is the IP/TV system client-side software, which communicates with the IP/TV 3411 Control Server to get information about all available programs and display a program listing. It allows participants to select and display programs, ask to receive a scheduled program, or choose to display a program on demand. (It informs the Control Server of what content is desired, and the control server then directs the content delivery

from the Broadcast or Archive servers.) The Viewer can list both available IP/TV format and Windows Media programs and offers VCR-like controls, key word searches and program pre-scheduling. [Although IP/TV content could also be accessed via an html web page and Windows Media Player, this client is required in order to receive archived content stored in Cisco's proprietary RTP format (sort of an encapsulated MPEG-4). We will require the Viewer on all client stations in order to benefit from RTP's high quality video compared with the bandwidth needed to receive it].

The configuration of the equipment is described later and portrayed in Figure 1.

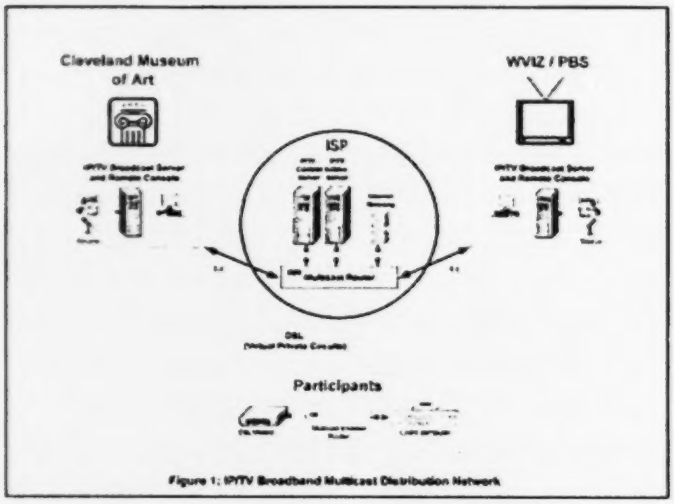

Figure 1: IP/TV Broadband Multicast Distribution Network

Supplemental Cisco software which should prove effective for providing, managing, and monitoring content development and delivery include:

- Web Presenter, which allows the opening of a video window and Web-based slides concurrently.
- Web Plug-in, which allows a participant to watch an IP/TV program embedded directly in a Web page.
- Question Manager, which provides a participants interactivity by letting participants type in questions on line. A moderator or instructor either answers the questions in real time or archives them for follow-up.
- Web Info, which allows participants, while watching a program, to click a button and travel to a predefined URL location, typically a Web page, containing additional program information.
- SlideCast, which permits participants to simultaneously see the presenter's PC-generated presentation materials in one window and the presenter in the other, as if they were in the same room.
- StreamWatch, which gathers participant demographics such as number of participating stations, identities, and viewing times for pre scheduled programs, and for on-demand programs logs information about which programs participants are watching and when.

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Ticket to Ride

Having tentatively selected the product suite that should meet the video capture, storage, management and distribution requirements of the project, the network infrastructure on which this would ride had to be identified. As noted earlier, the public Internet is anything but ready for broadband multicast prime time. We enlisted the assistance of a local major ISP who recognized the benefits of early involvement with broadcast multiband. Their assistance was also encouraged by their ongoing relationship with the local Cisco office, not to mention the prestige and good will associated with assisting the Museum. This A-Team team, now comprised of representatives of Keane, Inc. (consulting), APKnet (ISP), Cisco Systems, Inc., and Museum technical staff, along with any additional ad hoc experts we could think of to call or e-mail, set to task. I love it when a plan comes together (Smith, 1983)... and it did:

The network infrastructure would work as follows:

- As a DSL reseller through local telephone providers with direct lines to their central offices, the ISP would create private virtual circuits between themselves and our clients (ISP-to-TelcoPoP-to-client])
- The DSL client lines at the ISP could be then be connected to a single high speed, broadband, multiprotocol, multimedia router (Cisco 7206VXR) with a highly secure, specially configured gateway connecting it to the public Internet.
- The IP/TV Control and Archive servers would be co-located at the ISP and connected directly to the high speed router to assure the fastest and most direct service delivery. Demanded video would travel directly from the ISP to the client via the virtual private circuit. The servers could be operated remotely from any site with an authorized IP connection, yet benefit from the power management and physical security inherent in a ISP facility.
- Live broadcasts would be compressed and fed by Broadcast servers "on location" to the Control servers at the ISP via dedicated T-1's terminated at the same high speed router; similarly, video-on-demand archival material could be loaded onto the archive/media servers at the ISP using the same Broadcast servers via the same T-1's.
- Client locations would require multicast enabled routers (Cisco 1720) in addition to the DSL modems specified by the provider of the DSL loop.

This configuration establishes a fundamentally closed system. The ISP, which acts as the hub, maintains end-to-end control of all emanating lines. The project relies on a private IP routing scheme for our client stations and media servers. Remote management access is also protected through access control lists that permit access only to devices with authorized IP addresses, in addition to correct passwords. The gateway to the Internet, also located at the ISP, provides network address translation, thereby masking the identity of the originating workstations and servers. In turn, the gateway is configured to provide anti-spoofing protection and a multi-layered and firewalled environment to assure a high level of overall security for components of our system. Similarly, filtering at the gateway prevents our high bandwidth content from spilling into and degrading service on the ISP's Internet backbone. Overall, thanks to an ISP with end-to-end connection control and willing

to provide multicast broadband support for a small population, we expect to successfully emulate the Internet of the future.

Content Capture, Transmission and Display

While the fundamental infrastructure and core components of this project have been described, there are key ancillary devices and technologies worth noting, although elaboration exceeds the scope of this paper. For live transmission we will use MPEG-4 (http://www.cselt.it/mpeg/) with its high ratio of full-motion video quality to bandwidth and other features. For archival storage and video-on-demand we will use Cisco's RTP format, which is essentially encapsulated MPEG-4 requiring IP/TVViewer client software at the workstation. Content will be digitized locally using Broadcast Servers and downloaded/transmitted via T-1 to the Archive Server at the ISP hub.

Ancillary equipment associated with content production, distribution, and storage include video cameras, microphones, mixers, video editing system with special effects, video recorders, document cameras, slide-to-video projectors and others. Some of these were already available through our existing distance learning programs while others were acquired for this purpose.

Work stations at participant sites will be standard PC's with at least the equivalent of a PIII/600Mhz processor; the IP/TV Viewer uses the processor to decode MPEG-4 and RTP media. Also,128 MB RAM will be provided. At this time we have not identified any specific video or audio requirements beyond the minimum generally provided with current model workstations. Where a personal residence is the location of participation, standard small speakers and a 17" monitor will be provided. For group facilities, a 36" RGB monitor, appropriate speakers, and wireless keyboard and mouse (if desired) will be provided, along with any special cart or cabinet requested.

Program Operation and Management: Partners, Partners, Partners

The technology plan described, although at the core of the project, is merely a facilitator of the program. The program needs content to distribute and participants to participate. If one concedes that the Museum has designed a program that qualifies as "creative use" of technology on behalf of the Museum's strategic goals, then there still remains the question of where the mastery of complex technology should reside. The answer is, with those whose core competency is technology. Similarly, although the Museum has extensive experience in educational programming within the scope of its expertise, there is more to Lifelong Learning and the Arts than a single institution can provide. Finally, we needed to identify and enlist community facilities and residents who would be willing to join our experiment and work toward its success.

To achieve this level of distributed responsibility, participation and interest, three spheres of "Partners" have been convened, many of whom had been at our initial brainstorming meeting: Content Partners, Community Partners, and Technology Partners.

Content Partners is a consortium comprised of the Museum and additional arts and cultural institutions, including the Cleveland Orchestra, one of the finest in the world; the Crawford Auto-Aviation Museum of the Western Reserve Historical Society, a repository for artifacts and archives related to the history of Ohio; and, WVIZ/PBS, the area's public broadcasting station and active producer of educational television programs. The number of content partners may grow as the program matures. The combined resources of these organizations will provide a broad and varied menu of programs in the areas of local history, visual arts, jazz and classical music, theater and the applied arts, as well as a range of thematic programs about general artistic, cultural and literary issues. We are projecting a minimum archive of 300 programs by the end of year two, in addition to a minimum of 12 live broadcasts offered monthly. These organizations receive no payment for their contribution. It is noteworthy that TOP grant conditions unequivocally stipulate that funds may not be used to "produce information content," although it will support some "creation or conversion of content (in order) to utilize information infrastructure technologies to address real-world problems" (TOP Application Kit, 1999). For example, the program is funded to videotape an already planned lecture series, but cannot pay to create one. Content partner contributions of time and any direct expenses incurred on the project's behalf are recorded and considered in-kind match to the federal cash grant. The Museum's Education and Public Programs Division manages the Content Partners.

Community Partner organizations bring a diverse population to the program, including minorities and seniors, and those with varying levels of physical and mental abilities. Organizations include several assisted living community residential facilities; the Cuyahoga County Board of Mental Retardation's training center; and a college-based special educational program for persons age 50 and over. As the program matures, participation may change. The personal commitment of community partner staff is crucial to the success of the program. Community partners have committed the time and talents of their on-site staff to facilitate the use of the technology, to integrate the project into their ongoing program activities, and to create follow-up activities so that their clients can achieve the maximum benefit of this experiment. They have also agreed to encourage use of the system for video-on-demand and access to complementary Web resources. This includes making the equipment accessible to clients for independent as well as group use. The partners also agreed to take part in the evaluations, complete surveys and interviews, and send a representative to meet at least quarterly to discuss the program progress and recommend improvements. These organizations receive no payment for their contribution. Their contribution of staff time spent in activities, meetings or paperwork uniquely related to the project and any direct expenses incurred on the project's behalf are considered in-kind match to the federal cash grant. The Museum's Education and Public Programs Division manages the Community Partners.

Technology Partners comprises technology organizations whose core competencies are congruent with their projected roles. For example, APKnet, Inc., the major regional ISP referred to above, will provide end-to-end network management and connectivity services and support to our clients and content origination/management points; that is, the Museum and WVIZ/PBS. They will also co-locate the Archive and Control servers on their premises. WVIZ/PBS, the area's public television station, will remotely manage the Archive and Control servers,

including video-on-demand sources and broadcast scheduling. With an IP/TV Broadcast server on their premises, they will also provide their studio as a live broadcast venue as well as download content to the archive. Cisco Systems, Inc.'s Cleveland office has committed to a special technical support effort and has contributed training to assure that the project works. Keane, Inc. will help monitor and evaluate the implementation. Museum Information Technology staff manage the implementation process, and will perform all remote site equipment set-up (except network connectivity devices), provide help desk support for the project, and develop a friendlier end-user interface than is provided with the IP/TV package. The vendor partners are participating on the basis of fee-for-service and/or contribution/discount of services. Contributed time and services from technology partners are accorded a value, which is considered in-kind match to the federal cash grant. The Information Technology Division manages the Technology Partners.

Project Evaluation

Intrinsic to any federally funded project, and vital regardless of auspice, is the ongoing and final formal evaluation of project process and outcome. We have divided the evaluation into two distinct components: technology implementation and program effectiveness.

In order to assess our technology implementation, Keane, Inc. will identify and document all technical implementation, training and support issues, problems and resolutions. This record should serve as an important source document for any organizations that would like to replicate in whole or part the technical program we are modeling. Our Keane representative has been involved with the project from our initial investigations and has an exceptional understanding of what we are trying to achieve. However, since identifying the core technologies, Keane has not been involved in specification or implementation, thereby enabling an unbiased view of our process

In order to assess program effectiveness, we were fortunate to have enlisted the Institute for Innovative Learning, Inc., led by noted researcher John H. Falk. This non-profit research and evaluation organization specializes in "free choice" learning and arts-related programs and has extensive experience in evaluating Museum-based educational programs.. Formative and summative evaluations, based on integrated evaluation planning with all program partners, will encompass direct observations by evaluators, focussed and open-ended interviews, questionnaires for caregivers, and case studies as appropriate. Interim and final reports will assess the efficacy of our approach and promote the sharing of our experience. Ongoing informal feedback will help us navigate the program. This Institute's involvement began at the very onset of the program, even before our first formal *Partners* meetings were convened, and we believe that early involvement of evaluators is essential to the evaluation process

Budget and Staffing

The formal budget for this program is $1.2 million over a two-year period. Of this, $545,000 represents the Technology Opportunity Grant financial assistance award. The remainder is matched through the in-kind support of our Content, Technology, and Community Partners, and the Museum's dedication of time of existing management and staff, and direct expenses for some equipment and supplies. The federal

contribution is primarily used for hardware, software, initial network configuration, and monthly telecommunications charges. Approximately 10% is applied to evaluation. Federal dollars also directly fund 1.5 full-time equivalent positions at the Museum: a full-time Project Coordinator acts as a liaison between Program and Content providers and the Museum's project managers, evaluators and others, performing a variety of functions to assure that the program runs smoothly and effectively. A half-time Education Assistant works with all content and community partners, including Museum staff, to modify or enhance prospective content to better meet the needs of older or impaired participants. A variety of staff from both the Information Technology and Education and Public Program Divisions are involved with this project as needed. The Museum's Informaton.Technology Division's Help Desk also serves as the project's help desk. The Director of Education and Public Programs is responsible for program content and working relationships with our community partners. The Chief Information Officer, who heads the Information Technology Division and is Project Director, is responsible for all aspects of technical implementation, , all budget management, reporting requirements, and program evaluation.

Current Project Status

The grant award was announced on October 1, 2000. As this paper is prepared in mid-February, 2001, following many planning meetings, much of the IP/TV equipment has arrived. Technical staffs at WVIZ/PBS and APKnet have been experimenting with demonstration units for several weeks. Museum technical staff received a briefing and started demonstrating IP/TV features to our Community and Content partners. This proved a significant energizer for the group, who could finally see what they were getting and know that it was for real.

The only big surprise is that there haven't been any big surprises. Telecommunications lines have also been ordered and are at the brink of hook-up but here, too, no surprise.... local DSL providers do not really know if DSL is available at a location until the time of installation. Although we "pre-qualified" community partner sites last year, as to whether they could be connected, that turned out to be meaningless. Possibly two of our participants may get T-1 connections until DSL is really available. Site visits have been made to all community facilities, in order to perform facility surveys for equipment selection and set-up, and to start getting to know residents and staff (the "joy" part).

Our community partners have already participated in the baseline stage of the program evaluation, which entailed the on-site collection of baseline data about how staff feel about the forthcoming program, and about the current state of social isolation, activity and relationship with the arts of prospective participants. Here the feedback from our evaluator has already proven invaluable.

First, our informal feedback was that our Community Partners' staffs were extremely enthusiastic about the project and were already identifying additional ways of using the technology before our first program even "airs." For example, it was suggested that we share special programs currently at one facility with another, or allow residents' talents to be displayed live from our studios. One facility which has a regularly scheduled discussion of social and political issues suggested that we open it up for multi-facility participation or view. We are now challenged to harness this energy and level of ownership which we

never presumed to rely on, nor expected to achieve at start-up.

Second, we have discovered that facility staff are planning to target our programming toward persons who still maintain very active lives, and have strong longstanding interests in the arts and our cultural institutions. This may suggest that there is not much room for great improvements for these folk in life satisfaction from our "diminishment of social isolation" or "increased socialization" in this group (or maybe there is?). On the one hand, this population might actively help us evaluate the quality and effectiveness of our programming; on the other hand, this might preclude us from impacting on a more needy population, giving us no more than a short-term Pyrrhic victory. On the third hand, we do not want to dampen staff enthusiasm or set ourselves up for self-fulfilling failure either by second guessing their judgement or foisting our programs on participants before we have ironed out the kinks. For now, we believe we have elegantly solved this trilemma. We will enthusiastically beam our programming toward the audience of the facilities' choice, respond to their feedback and analyze our impact. As we become more experienced at content selection and delivery, and facility staff become more confident in their use of the technology and the success with their audience, we may urge that the audience be expanded to those thus far deprived of participation. We may even find that this occurs naturally over time without our intervention.

The relevance of this scenario is not so much the problems and issues it describes. More importantly, this story illuminates the critical importance of early independent evaluation of program progress, and thoughtfully deliberate intervention (or in this case lack thereof). Without the early warning, this may have become an urgent issue bordering on adversarial. Instead, we share an abundance of lemonade.

Content partners have also been meeting to develop our program schedule, and the wealth of ideas is breathtaking: a special live marimba and organ concert; our Art of the World appreciation course for adults, videotaped and parsed into small morsels and archived for demand, complemented by live follow-up conversation from the museum; an historian showing neighborhoods of yesterday and today to stir memories, emotions, and intellect; a Panorama of African American Theater from WVIZ/PBS. These are ideas and plans, and fodder for another paper. One challenge will be to develop the synergy of this program with the existing programs of the Content Partner institutions. Recalling that grant conditions unequivocally stipulate that funds may not be used for content development, it becomes all the more important to sense what existing programs may be most amenable to re-purposing for this program audience and technology. Another challenge will be to choose programs selectively and carefully, learning from those that have proven most and least effective and popular. Additionally, we may need to consciously differentiate or vary programming to best match differently skilled members of our target population. Learning from our success in art classes with impaired populations, we will probably include live and archived activity lessons, with guides for staff. Only one cloud hangs overhead; that is concern raised by some content partners that in their enthusiasm for our program goals, they may have underestimated the need for their institutions' unreimbursed commitment of time and resources. This may result in a need to attract more content partners, or our partners may find that their contributions are not so onerous after all.

As we continued to walk through and talk through this program, we

recognized one more question to confront: Why should staff at our Community Partner facilities actually believe this could be significantly beneficial to their residents - more beneficial than TV or any other leisure activity? Staff attitude in fact might prove key to project success. To help establish insurance in this area, the Museum produced a day-long seminar, demonstration, and pizza lunch for all of our Partners (Technology, Community, Content). We featured a special film and lecture presentation by gerontologist Mal Schechter, who had helped with our original research. Staff from the Cuyahoga Community Board of Mental Retardation and Developmental Disabilities demonstrated how technology benefits the lives of the people they serve. All of us focused on why we believe that this program is not just entertainment; it's life enhancing. A pre-kickoff rally. And it got rave reviews.

Conclusion

This paper has tried to present the evolution of a notion as it becomes an innovation. It has tried to relate the importance of matching an institution's persona to an almost far-fetched goal. It tries to make a case for developing sound inter-organizational relationships as a means of achieving projects that would otherwise be out of reach. And of course we are trying to demonstrate how advanced telecommunications may bring cultural organizations closer, and with more profound impact, into many more lives, in the not too distant future. If the process described seemed too well thought out, too much on an even keel, a piece of cake, then I may have abused my literary license. Guilty as charged on bypassing some of the bumps in the road; we are just too busy trying to catch sight of the potholes in the darkness ahead. But really, don't you just love it when a plan comes together!

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